Behavior of Housefly to Certain Organic Phosphorus Insecticides : Insect Repellents and Attractants. VII.

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diet. The differences detween these larger and smaller values were significant.

4. Per cent area truncated for the calculation of the cumulative frequency curve of pupal length was decreased with the increasing of the compressed diet used. When the quantity of rice bran exceed that of the compressed diet, it shows the phenomenal decrease. Differences between these higher and lower percentages were significant.

5. The maximum standard deviation of pupal length was obtained in the culture medium mixing 15 g of the compressed diet and 35 g of rice bran. The differerences between this maximum value and other values were significant. Excluding this maximum value, differences within other values were not significant statistically. But the smaller values were obtained in the culture media used the greater quantity of the compressed diet.

6. Per cent pupations obtained in the culture media in which the quantity of rice bran were used over twice the quantity of the compressed diet were lower compared with that obtained in the other culture media and the differences between these lower and higher values were significant. The per cent pupations obtained in the culture media in which the quantity of the compressed diet were used over that of rice bran were equally higher, but the differences between these values were not significant.

7. Thinking collectively from the result of the present experiment a conclusion can be drawn that in the mass culture of the common housefly using the modified Kitaoka's culture medium many houseflies suitable for biological assay of insecticides will be reared in the culture media using the greater quantity of the powdered Oriental compressed diet than that of the rice bran and it is desirous to set limits to the culture medium in which the compressed diet and rice bran are used equally.

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4. 有機燐殺虫剤に対するイエバエの反応 忌避剤・誘引剤について 第7報

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イエバエが有機燐殺虫剤に対してどの様な反応を示すかを知るため，毒餌摂食法を用いて室内的に試験した。供試した殺虫剤は，比較的低毒性で衛生防疫用に広く使われている DDVP，ダイアジノン，ディプテレックス，マラソン，コーラン (Korlan : *o, o*-dimethyl *o*-2, 4, 5-trichlorophenyl phosphorothioate)，および対照のためのピレトリンの6種である。イエバエはこれらの殺虫剤に誘引されるが，その施用薬量が多い場合には若干忌避する傾向が見られた。とくに興味あるのは，DDVP にイエバエが強く誘引されることで，薬量の多少に拘らずその処理面に好んで集り，短時間中に転倒した。

In order to ascertain the behavioristic reaction of housefly to certain organic phosphorus insecticides, the following tests were performed under laboratory conditions. The method employed was essentially a poisoned-bait application. The insecticides adopted for the tests were DDVP, diazinon, dipterex, malathion and korlan, which had been widely used for household sprays. Although flies were attracted to these materials, they slightly repelled them when applied in higher dosage. It is an interesting feature that flies were attracted to DDVP independent of its dosage applied. Flies were fond of the surface treated with DDVP and were knocked down for a little while.

Recent studies in the United States and other countries have revealed certain field strains of housefly to become resistant to several formerly effective organic phosphorus insecticides such

* Dispatched from Takamine Laboratory, Sankyo Co., Ltd,

as malathion, parathion, diazinon, and dipterex[1,2,4,5]. Especially, malathion resistance in some housefly strains are confirmed in laboratory tests to be due to the behavioristic resistance of these flies to avoid malathion baits, so as to decrease the insecticidal efficiencies of malathion residues[1].

On the other hand, it is generally said that flies crowd on the place where has been treated with certain insecticide such as DDVP. If an insecticide has a strong attractive power, insects will be fond of the material. The attractiveness may encourage the insect to take up lethal doses satisfactorily.

In the present paper, the author has dealt with comparative tests on behavioristic reaction of a certain strain of the housefly to some organic phosphorus insecticides.

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Materials and Methods

The materials adopted in the experiments were DDVP (tech. 90%), diazinon (tech.), dipterex (tech.), malathion (tech.), korlan (a finished product, 44% emulsifiable liquid), and pyrethrum extract containing 15.0% of pyrethrins. Each of these materials was formulated as 0.05%, 0.5% and 5% acetone solutions.

The insect used was the adults of the common housefly (DKM-Strain), *Musca vicina* Macq., which had been bred in this laboratory since 1955. The flies tested were 3 or 4 days old, and selected at random without regard to sex. They were starved for 5 hours before testing.

Table 1. Per cent knockdown and mortality of the houseflies exposed to two filter papers, one of which contained an insecticide plus sugar solution, while the other sugar solution only. Average of three replicates.

Material	Dosage applied	Proportion of flies on paper		Knockdown percent Time in minute (at 21°C)			Mortality
	mg/30cm²	Treated	Untreated	10	30	60	24 hours (at 15-21°C)
DDVP	500	0.68	0.32	88.4	100.0	—	100.0
	50	0.96	0.04	60.0	100.0	—	100.0
	5	0.79	0.21	51.7	83.3	95.0	79.3
Diazinon	500	0.45	0.55	61.7	95.0	100.0	100.0
	50	0.44	0.56	20.0	76.7	93.3	86.7
	5	0.51	0.49	26.7	63.4	88.3	89.5
Dipterex	500	0.16	0.84	35.0	60.0	85.0	89.3
	50	0.50	0.50	36.7	86.7	90.0	88.4
	5	0.44	0.66	26.7	60.0	83.4	91.2
Malathion	500	0.33	0.67	51.7	93.4	95.0	96.3
	50	0.39	0.61	26.7	56.7	73.3	75.0
	5	0.82	0.18	38.4	81.7	98.4	75.9
Korlan	500	0.19	0.81	25.0	56.7	83.4	84.3
	50	0.17	0.83	0.0	56.7	76.7	73.4
	5	0.67	0.33	20.0	73.4	90.0	79.3
Pyrethrins	250	0.18	0.82	50.0	80.0	80.0	63.3
	50	0.12	0.88	6.7	24.2	43.4	17.5
	5	0 13	0.87	36.7	48.9	53.3	46.4

Table 2. Per cent knockdown and mortality of the houseflies exposed to a filter paper which contained an insecticide and sugar solution. Average of three replicates.

Material	Dosage applied mg/30 cm²	Knockdown percent Time in minute (at 21°C)			Mortality 24 hours (at 15-21°C)
		10	30	60	
DDVP	500	56.7	100.0	—	100.0
	50	66.7	100.0	—	100.0
	5	96.7	100.0	—	82.1
Diazinon	500	80.0	96.7	100.0	100.0
	50	68.4	98.4	100.0	90.0
	5	56.7	93.3	100.0	89.3
Dipterex	500	63.3	96.7	100.0	100.0
	50	68.4	98.4	100.0	92.5
	5	76.7	96.7	100.0	89.3
Malathion	500	76.7	90.0	100.0	100.0
	50	69.2	96.7	100.0	77.5
	5	60.0	93.3	100.0	78.6
Korlan	500	6.7	80.0	96.7	100.0
	50	27.5	87.5	100.0	80.0
	5	20.0	93.3	100.0	75.0
Pyrethrins*	250	100.0	—	—	100.0
	50	100.0	—	—	100.0
	5	100.0	—	—	87.5

* Confining method employed.

a. Measurement of Behavioristic Reaction based on a Choice between Poisoned and Non-poisoned Baits.

Round pieces of filter paper, 5 cm in diameter (ca. 20 cm²), were soaked with 0.21 cc of acetone solutions containing the toxicants in the desired concentration, and after evaporating the main part of the solvent, the treated paper was placed in a glass dish of 9 cm in diameter. The treated paper was then moistened with 0.6 cc of 2% sugar solution. At the same time, untreated paper which contained only the same amount of the sugar solution was provided. A pair of the treated and untreated papers were placed in the test cage which consisted of net-screened cage, 15 cm in diameter and 10 cm in height. The tests were made by introducing 30 flies into the cage. The flies were allowed to select either of the two papers. During the exposure, number of flies congregating on the papers and those knocked down was counted at 10-minutes intervals. The treated and untreated papers were removed at the end of one hour test period, and the flies were fed with fresh sugar solution. After 24 hours, mortality counts were made.

b. Measurement by Using a Compulsory Feeding.

Test methods and conditions were nearly the same to those mentioned above. In the tests, however, applying paper was only one containing the test insecticide plus sugar solution so as to force the hungry flies to eat the poisoned bait.

Results and Discussion

In these experiments the criterion of repellency or attractiveness was based upon the number of flies congregating on the treated or untreated papers and the subsequent knockdown percentage and mortality. If the material is attractive the insects will be found more abundantly on the treated paper than on the untreated, and higher knockdown percentage and the subsequent higher mortality of the flies can obtained, whereas if the material is repellent to flies, they will be found abundantly on the untreated paper, consequently, lower knockdown percentage and mortality is expected.

The results are given in Tables 1 and 2. In the first tests, proportion of flies on the papers treated or untreated was reckoned from total number of flies counted at 10-minutes intervals.

DDVP. This is extremely attractive to flies, and a considerable fumigant action is also observed. The instant flies perceived the odor, they followed the direction of source of the odor, crowded immediately on the paper containing poisoned bait, and are knocked down by the fumigant activity of the material.

Diazinon. No significant effect, both repellent or attractive, was observed for diazinon. However, in the other more practical tests it was found that this material was outstandingly effective for poison-bait applications when used in combination with sugar or other sweetenings.

Dipterex. This material was slightly repellent when excessive dosage was used, while it was significantly attractive with lower dosage. Thus, as shown in Table 1, higher proportion of fly attraction and subsequent higher mortality after 24 hours were obtained in the treatment with lower dosage.

Malathion. Flies were attracted to malathion when the dosage applied was lower, but in the case of the higher dosage, an evidence of a little avoidance could be observed.

Korlan. The material used was in a commercial form which contained some supplements such as emulsifier and solvent, so that the real activity of this material could not be determined properly.

Pyrethrins. It has already been recognized that pyrethrins act repellently to houseflies[3]. Though flies flied away the moment they touched the treated paper, an appreciable knockdown percentage and mortality were observed. This might be due to the fact that the dosages applied are too excessive. High knockdown percentage and mortality given in the second tests may result from the confining of the flies in small Petri dishes and the subsequent frequent contact with the materials.

Résumé

In the present paper, the author dealt with comparative tests on behavioristic reaction of a strain of housefly to some organic phosphorus insecticides, DDVP, diazinon, dipterex, malathion, and korlan.

Flies of this strain repelled the insecticide-baits when applied in higher concentration, whereas were attracted to them when applied in lower dosage. DDVP was an exception, viz, flies were attracted to this material independent of its dosage applied.

References

1) Fay, R. W., J. N. Kilpatrick and G. C. Morris : J. Econ. Entomol. **51**, 452 (1958).
2) Hansens, E. J. : J. Econ. Entomol. **51**, 497 (1958).
3) Ikeda, Y. : Botyu-Kagaku **22**, 323 (1957), **23**, 33, 99, 102 (1958).
4) Kilpatrick, J. W. and H. F. Schoof : J. Econ. Entomol. **51**, 18 (1958).
5) Schoof, H. F. and J. W. Kilpatrick : J. Econ. Entomol. **51**, 546 (1958).